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1. Systems and methods for a **partial sum** digital **fir** filter - US ...

US Patent 6718355 - Systems and methods for a **partial sum** digital **fir** filter **...** loading... View Patent Images (**PDF**) (Registered users only) **...** a multiplier configured to multiply the sum by a gain **coefficient** producing a product, and **...**
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2. Distributed arithmetic digital filter in a **partial**-response ...

View Patent Images (**PDF**) (Registered users only) **...** means for storing a plurality of **partial sums** of predetermined tap weights; **...** means for calculating predetermined filter **coefficients** using said calculated **...** A finite impulse response (**FIR**) digital filter as recited in claim 6 wherein said **partial sum** storing **...**
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3. **Partial sum** filter and method therefore - Patent 6301596

by M Karanovic - 2001 - Cited by 2 - Related articles
Download **PDF** 6301596 · **PDF** help. Export Citation: **....** Therefore, a need exists for a **partial sum FIR** filter that has a reduced **....** A number of iterations using a number of **different** input values and **coefficients** will be performed to **...**
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linear phase **FIR** filters. This paper presents a new contention **... different coefficients**. By representing the set of canonical signed **...** An intra-**coefficient** (horizontal) subexpression is a **partial sum** of **...**
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5. **FIR** filter synthesis algorithms for minimizing the delay and the ...

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tial sum requires a **different** number of adder-steps, the partial **....** size a **coefficient**, the **partial sums** selected for the **coefficient ...**
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6. Complex Filtering with the HSP43168 Dual **FIR** Filter

that a **different coefficient** set is used on alternate clocks. Real **coefficients** and imaginary **....** Therefore, FIRA calculates one of the two **partial sum** of **...**
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7. **FIR** Filter Synthesis Algorithms for Minimizing the Delay and the ...

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have **different** adder-steps, depending on the structure of multipli- cation. **...** a **coefficient** is completed, the **partial sums** stored in the temporary **...**
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8. An area-efficient VLSI implementation for programmable **FIR** filters ...

by T Poonnen - 2006 - Cited by 2 - Related articles - All 3 versions
References. References - selected. **PDF** (355 K) **....** Let the resulting 2-1 **partial sum** signals be denoted by pt, t = 1, 2, ..., (2-1) **..... different** configurations of the proposed multibit-**coefficient FIR** filter architecture, shown in Fig **...**
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9. [PDF] A VLSI **FIR** Digital Signal Processor Using Logarithmic Arithmetict

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partial sum is then used as input during the second cycle which uses **different** data and **coefficients**. This pattern continues until completion of the fourth **...**
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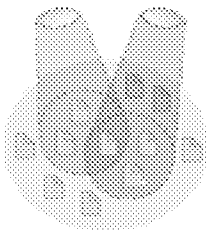

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FIR Filter Structures

Module by: Douglas L. Jones. E-mail the author

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Summary: The direct-form and transpose-form structures are most commonly used to implement FIR filters. For certain special filters, recursive implementations require less computation. Lattice and cascade structures are occasionally also used.

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Consider causal FIR filters: $y(n) =$

$$\sum_{k=0}^{M-1} \left(h(k)\, x(n-k) \right)$$; this can be realized using the following structure

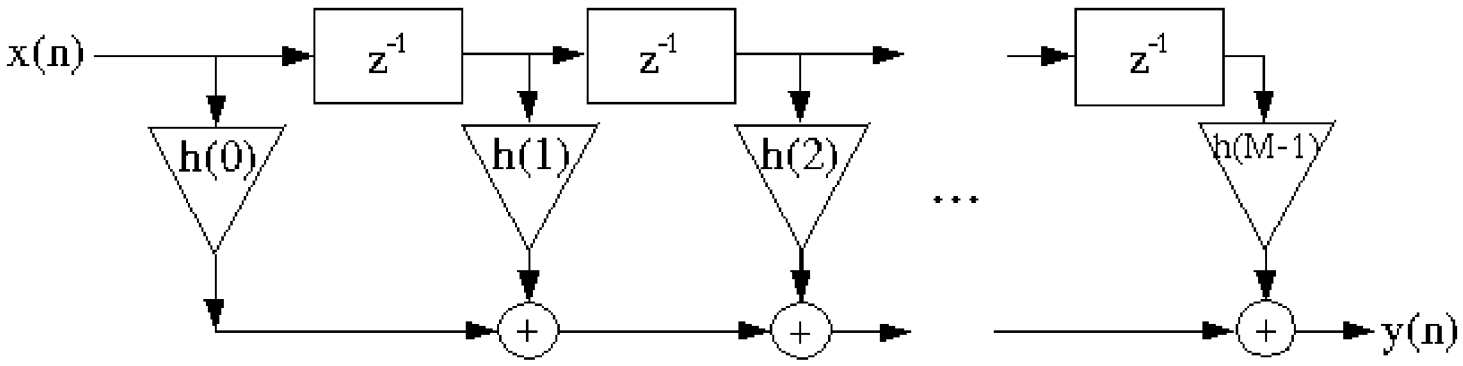


Figure 1

or in a different notation

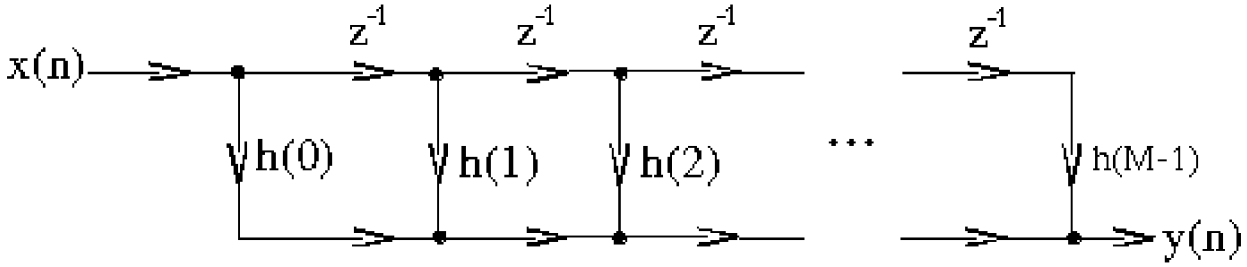
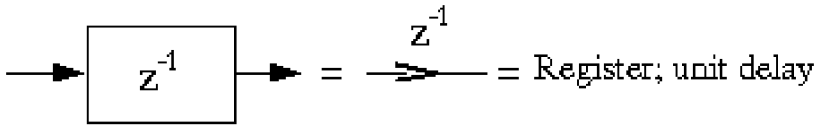


Figure 2

(a)



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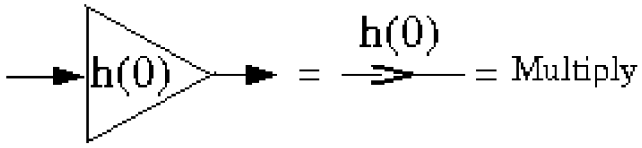

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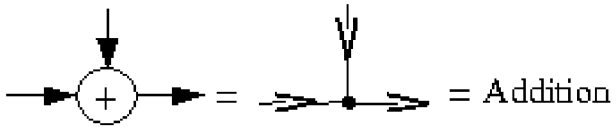

Figure 3

This is called the *direct-form FIR filter structure*.

There are no closed loops (no feedback) in this structure, so it is called a *non-recursive structure*. Since any FIR filter can be implemented using the direct-form, non-recursive structure, it is always possible to implement an FIR filter non-recursively. However, it is also possible to implement an FIR filter *recursively*, and for some special sets of FIR filter coefficients this is much more efficient.

Example 1

$y(n) =$

$$\sum_{k=0}^{M-1}$$

$(x(n-k))$ where $h(k) = \{0,0,1,1,\ldots,1,1,0,0,0,\ldots\}$ But note that $y(n) = y(n-1) + x(n) - x(n-M)$ This can be implemented as

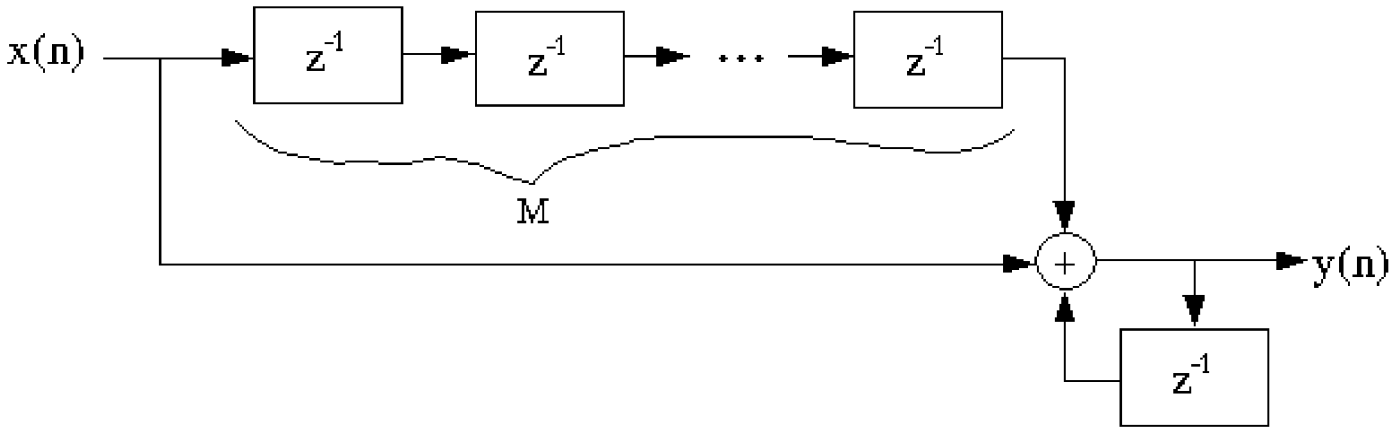

Figure 4

Instead of costing $M-1$ adds/output point, this comb filter costs only two adds/output.

Exercise 1

Is this stable, and if not, how can it be made so?

IIR filters must be implemented with a *recursive* structure, since that's the only way a finite number of elements can generate an infinite-length impulse response in a linear, time-invariant (LTI) system. Recursive structures have the advantages of being able to implement IIR systems, and sometimes greater computational efficiency, but the disadvantages of possible instability, limit cycles, and other deletorious effects that we will study shortly.

Transpose-form FIR filter structures

The *flow-graph-reversal theorem* says that if one changes the directions of all the arrows, and inputs at the output and takes the output from the input of a reversed flow-graph, the new system has an identical input-output relationship to the original flow-graph.

Direct-form FIR structure

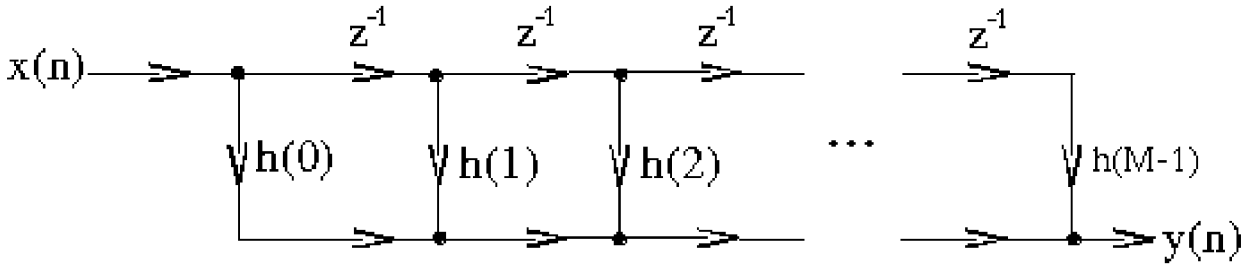

Figure 5

reverse = transpose-form FIR filter structure

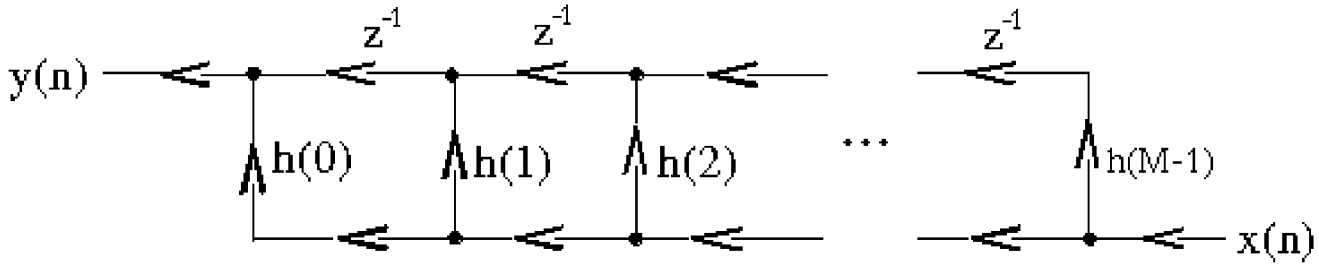

Figure 6

or redrawn

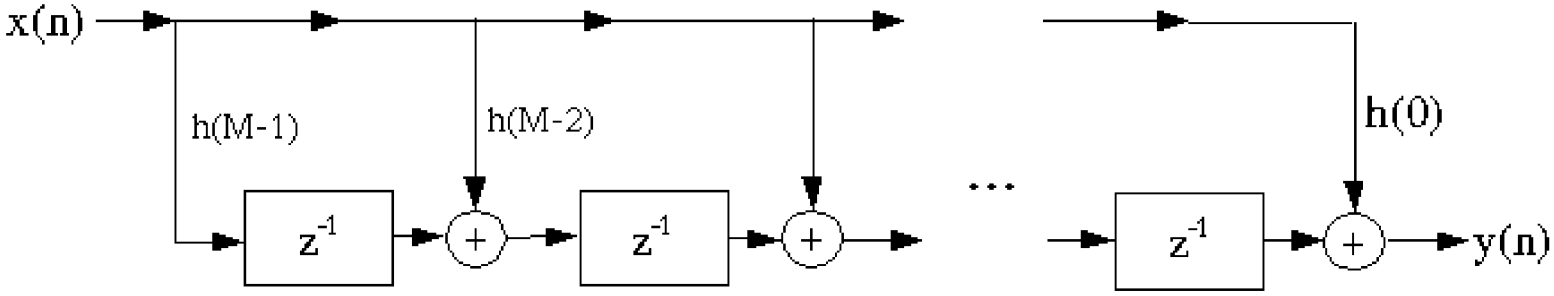

Figure 7

Cascade structures

The z-transform of an FIR filter can be factored into a cascade of short-length filters $b_0+b_1z^{-1}+b_2z^{-3}+\ldots+b_mz^{-m}=b_0(1-z_1z^{-1})\ (1-z_2z^{-1})\ \ldots(1-z_mz^{-1})$ where the z_i are the zeros of this polynomial. Since the coefficients of the polynomial are usually real, the roots are usually complex-conjugate pairs, so we generally combine $(1-z_iz^{-1})\ (1-z_iz^{-1})$ into one quadratic (length-2) section with *real* coefficients $(1-z_iz^{-1})\ (1-z_iz^{-1})$ =1−2ℜ$(z_i)\ z^{-1}+(|z_i|\ )^2z^{-2}=H_i(z)$ The overall filter can then be implemented in a *cascade* structure.

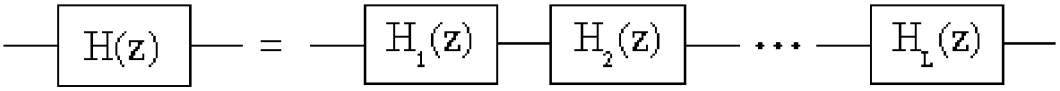

Figure 8

This is occasionally done in FIR filter implementation when one or more of the short-length filters can be implemented efficiently.

Lattice Structure

It is also possible to implement FIR filters in a lattice structure: this is sometimes used in adaptive filtering

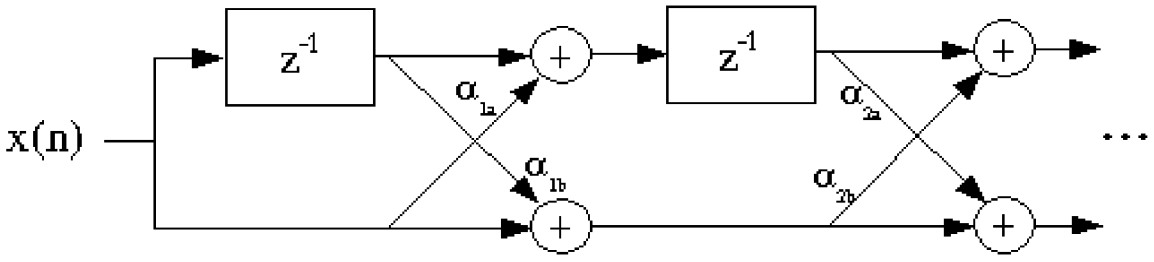

Figure 9

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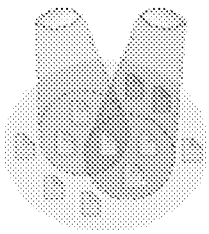

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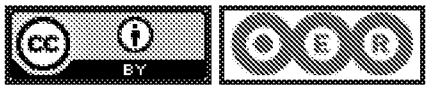

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